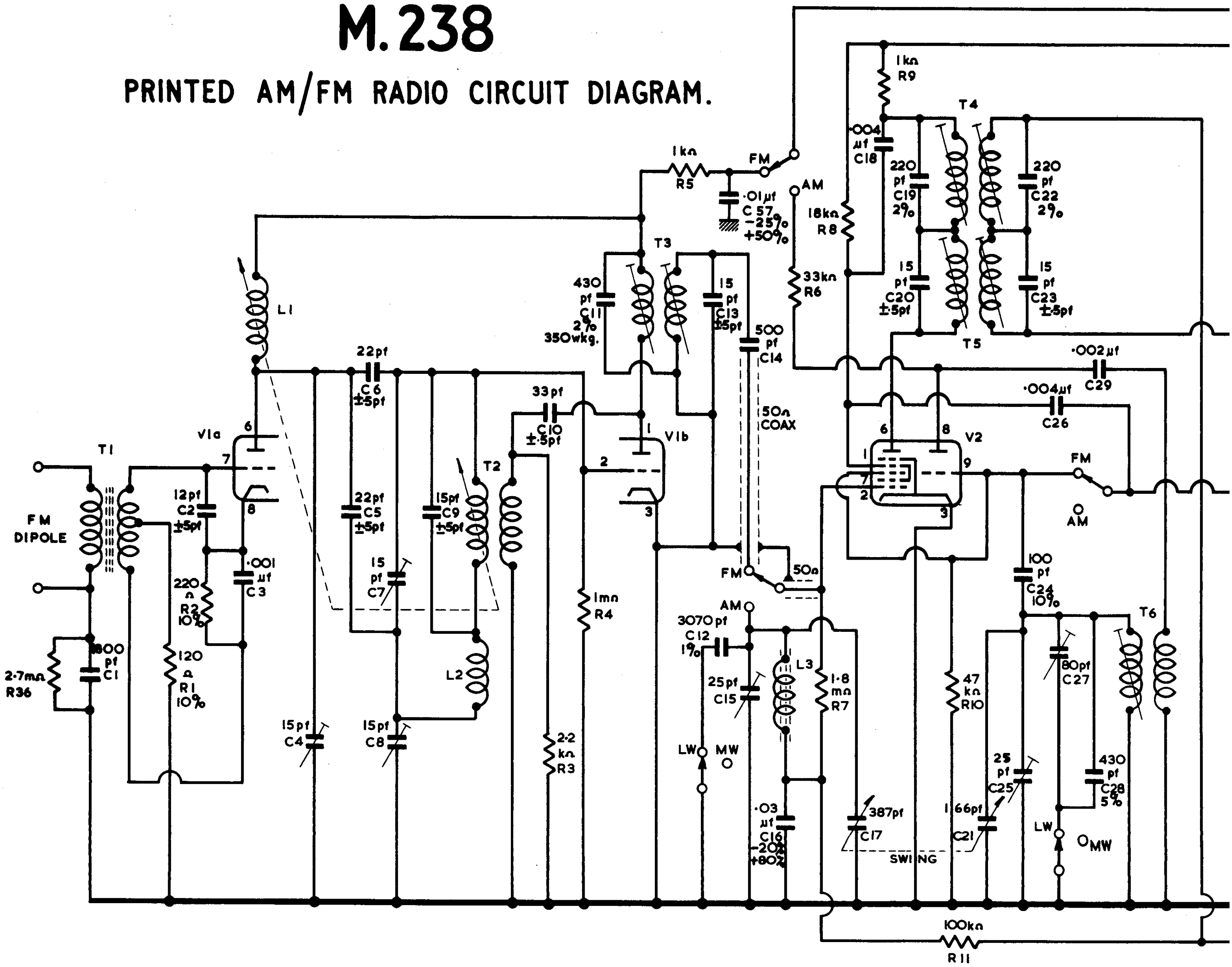
M.238

PRINTED AM/FM RADIO CIRCUIT DIAGRAM.



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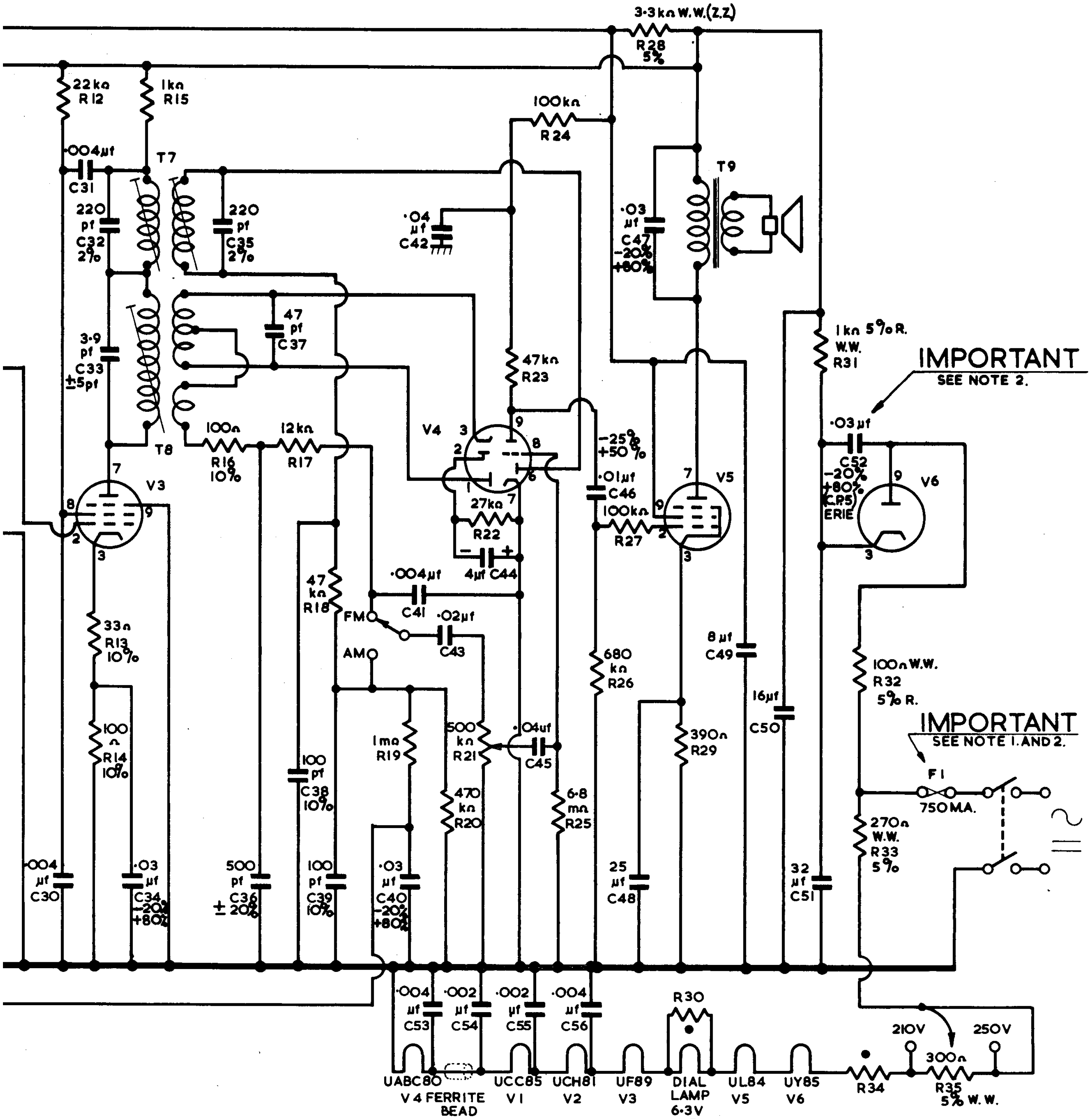

NOTE 1. THIS FUSE MUST BE REPLACED BY CORRECT 750 M.A. RATING.
NOTE 2. SEE NOTES IN SERVICE INFORMATION SHEETS.

RADIO RENTALS LTD.

TECHNICAL CENTRE, WEMBLEY

TECHNICAL INFORMATION SHEET

No. 24

RADIO MODEL 238 No. 1 DATE August, 1960.

Special Warning:
See end of these notes.

MODEL 238 AM/FM RADIO:

The M.238 is designed to operate on AC or DC mains supply between 200 and 250 volts, and to receive broadcasts on Long Wave, Medium Wave and VHF Bands. On Medium Wave the range is 180-550 metres, Long Wave is preset on 1500 metres and VHF covers 88-100 Mc/s. frequency modulated. A ferrite rod aerial is used on Medium and Long Wave Bands. On FM an internal aerial is fitted with provision for an external aerial, if required.

Six valves are used and all are common to AM and FM except the UCC85, which is used on FM only. The valves are :

UCC85, UCH81, UF89, UABC80, UL84, UY85.

The wavechange switch is used for switching from Medium Wave to VHF. Turning the Tuning Control to its fully anti-clockwise position switches the receiver from Medium Wave to Long Wave Light Programme.

CIRCUIT DESCRIPTION AM:

The Ferrite rod L3 is tuned by C17 + C15 on M.W. and C17 + C15 + C12 on L.W. and is connected to the control grid of the UCH81 valve (V2) through the AM/FM switch.

The oscillator is a parallel fed tuned grid type using the triode section of V2. On M.W. the grid coil is tuned by C21 and C25. Long Wave is preset by C27 and C28, these two capacitors being switched in when the tuning gang is turned to minimum capacity. C27 is the L.W. oscillator trimmer.

Trimming on M.W. is by C25 and padding by the core of T6. The signal frequency and the oscillator frequency are mixed in the heptode section of V2, and the resultant Intermediate Frequency (470 Kc/s) is developed across T4. I.F. transformer, which is coupled to V3 (UF89) a variable mu pentode. The output of this valve goes through the second IF transformer T7, to the detector diode of the UABC80 valve (V4). The detector circuit consists of R18, C39, C38 which form an IF filter, and R20, which is the diode load.

The audio component is developed across this resistor and fed to the volume control via the AM/FM switch. Further smoothing of the detector voltage is done by R19, C40, R11 and C16 to give a negative DC voltage which is applied to the grids of V2 and V3 as A.V.C.

CIRCUIT DESCRIPTION FM:

The signal from the FM aerial is coupled to the grid of the first triode section of the UCC85. (V1a) by the aerial input transformer T1, which is tuned to mid-band and tapped to provide neutralisation. The output, at signal frequency, developed across the tuned circuit L1 and C4 is fed into the self oscillating mixer stage (V16) through a bridge network made up of C5, C6, C8 and the Cgk of V1b. This bridge prevents the oscillator voltage from being fed back into the aerial circuit. The bridge is adjusted by C8.

The oscillator is a parallel fed tuned grid type working on the low side of the signal frequency. Permeability tuning of the oscillator and HF coils L1 and T2 is used, the cores of which are ganged together and moved in and out of the coils by a cam arrangement on the AM tuning gang. Coil L2 is in series with T2, which, together form the oscillator inductance. Adjustment of L2 and C7 enables correct frequency coverage to be obtained. The secondary of T2 and C10 form the feedback circuit for the oscillator, while R3 stabilises the output over the band. Mixing takes place in V1b and the resultant IF output (10.7 Mc/s) goes via T3, C14 and the AM/FM switch to the grid of the UCH81.

Tuning capacity for T3 primary is C10.

The UCH81 is used as a straight IF amplifier. On FM the AM oscillator is switched off and the oscillator grid earthed to prevent feedback.

The IF component developed across R5 is fed back to the grid of V1b via L1 and C6 to give positive feedback; this reduces the damping effect of the valve on T3. The amount of feedback is determined by the value of C11 which affects the gain and bandwidth of tuner. The IF output of V2 (10.7 Mc/s) is passed through T5 to the second IF stage V3 (UF89) which drives the ratio detector. Neutralisation is applied on both the UCH81 and the UF89 valves by C18, C26 and C30, C31 respectively.

The ratio detector is comprised of T8, C37, R22, C44, R16, C36 and two diodes in the UABC80. From the junction of R16 and C36 the audio signal is taken through an RF filter R17 and C41 to the AM/FM switch.

The output from the switch either AM or FM passes through C43 to the volume control and then via C45 to the grid of the A.F. triode section of the UABC80. 'Contact Potential' Bias developed across R25 is used on this stage. The audio output is taken from R23 via C46 to the output valve UL84 (V5), R27 is a grid stopper. Automatic bias is provided by R29 and C48. Matching of the low impedance speaker to the valve is by the transformer T9. Capacitor C47 is for tone correction.

HT voltage is supplied by a half wave rectifier UY85 (V6), with reservoir capacitor C51. A surge limiter R33 is included in the anode feed. The rectified voltage is smoothed by R31 and C50 and is further smoothed by R28 and C49 to feed the tuner and first AF stage. Capacitor C52 is to reduce pickup of signal from the mains supply.

The heaters of the valves are fed in series with resistors R33, R34 and R35, the latter is shorted out on the 210V tapping. R34 is a varite which prevents a surge current on 'switching on'. The dial lamp is shunted by R30 also a varite, so that failure of the lamp does not break the heater chain. Capacitors C53, C54, C55, C56 and the ferrite bead are heater decoupling components.

SPECIAL WARNING:

C52 is an Erie Type CP5 and the correct type must be used for replacement purposes as failure could cause serious damage to the printed panel. For the same reason, the fuse must be the correct 750 M/A rating to protect against component failures.

MODEL 238 AM/FM PRINTED CIRCUIT RADIO:

All voltages measured relative to chassis and DC unless otherwise stated. Measurements made with Avo Model 7 on 400V range unless stated otherwise. On AM and FM made with no signals and volume control at minimum.

100V range indicated thus +
10V range indicated thus x
1V range indicated thus =

Voltages for input of 240 volts AC on 230/250V tap. 20,000 ohm per volt/meter.

First line taken on F.M. Second line AM in each case.

P.T.O.

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	
UCC85	A2	G2	k2	H	H	a1	G1	k1	S	
	135	-	-	48AC	25AC	135	.5	2	-	FM
	-	-	-			-	-	-	-	AM
UCH81	G2.G4	G1	k.G5.S	H	H	AH	G3	At	Gt	
	77 +	.5 :	-	48AC	67AC	180	-	-	-	FM
	73 +	.5 :	-			190	.3 x	53 +	.3 :	AM
UF89	S	G1	k	H	H	S	A	G2	G3	
	-		1.5 x	80AC	67AC	-	190	180	-	FM
	-	.5 :	1.5 x			-	195	185	-	AM
UABC80	A3D	A2D	k2D	H	H	A1D	kt.kl. D1	G	A	
	-	.6 :		25AC	-	-	-	.4 :	55	FM
	.08 =	.6 :	.08 =			-	-	.4 :	60	AM
UL84	IC	G1	k	H	H	IC	A	IC	G2	
	-	-	12.5	123AC	80AC	150	185	185	150	FM
	-	-	15.0			175	190	190	175	AM
UY85	IC	IC	k	H	H	IC	IC	IC	A	
	240AC	-	260	160AC	123AC	235AC	-	-	235AC/FM	
	240AC		265							AM

	AM	FM	
HT line	265	260	)
HT1 "	195	190	) Volts DC
HT2 "	175	150	)

Heater current 96 MA)measured
Dial lamp current 96 MA)moving
Mains supply current 210 MA AC AM)iron
Mains supply current 220 MA AC FM)meter

	AM	FM	
HT line	63	67	)
HT1 "	59	56	) MA DC
HT2 "	4	11	)

UL84 cathode current 38 MA

AM oscillator grid current	1500 Kc/s	112 uA
	600 Kc/s	110 uA
	200 Kc/s	95 uA
FM oscillator grid current		1-1.5 uA

Hum level min. volume = 8 MV p/p
Hum level max. volume = 8 MV p/p

RADIO RENTALS LTD.

TECHNICAL CENTRE, WEMBLEY

TECHNICAL INFORMATION SHEET

No. 25

RADIO

MODEL	No.	DATE
M.238	2	Dec., 1960.

M.238 AM/FM RADIO ALIGNMENT PROCEDURE:

The alignment procedure described below must only be attempted where the necessary equipment is available.

Equipment Required:

1. Calibrated signal generator 100 Kc/s - 2 Mc/s A.M. modulated.
2. Calibrated signal generator 10 Mc/s - 100 Mc/s AM/FM modulated.
3. Hexagonal trimming tool.
4. Insulated screwdriver trimming tool.
5. Output meter (Avo meter on .1 amp AC range suitable).
6. Valve voltmeter.

I.F. Alignment A.M. (470 Kc/s):

Alignment must be done in the following order :-

1. Unscrew all cores on transformers T3, T4, T5, T6, T7 and T8 until flush.
2. Set wavechange switch to MW.
3. Set gang to fully meshed position.
4. Inject a 470 Kc/s modulated signal to pin 2 of the UCH.81.
5. Using the hexagonal trimming tool, adjust cores for maximum reading on the output meter in the following order :-
    1. Bottom core of T7 (secondary)
    2. Top core of T7 (primary)
    3. Top core of T4 (secondary)
    4. Bottom core of T4 (primary)

Maintain volume control at maximum, reducing the generator output as circuits come into line, to prevent AGC circuit operating.

Repeat operations 1 to 4 at least once.

Medium Wave Calibration:

With wavechange switch in MW position, set pointer to the dot at the extreme right-hand end of the MW scale, when the gang is fully meshed.

Turn pointer to 500 metres, inject a 600 Kc/s signal using coupling loop set approximately 4" behind and in line with the ferrite rod aerial.

Tune in the 600 Kc/s signal with the core of T6 for maximum output. Turn pointer to 200 metres and inject a 1500 Kc/s signal. Tune C25 and C15 for maximum output. Repeat both operations until no improvement can be obtained.

Long Wave:

With wavechange switch still in medium wave position, turn gang to fully open position (minimum capacity). Inject 200 Kc/s and adjust C27 for maximum output. If the Light programme interferes with this adjustment, then the station can be used in place of the generator.

This completes the A.M. alignment.

F.M. Alignment:

I.F. Stages:

Set wavechange switch to F.M. position.
Volume control at maximum.
Connect signal generator, which should be terminated with an 80 ohm resistor, to the grid of the UCH.81 (pin 2).
Set generator to 10.7 Mc/s modulated AM.
Valve Voltmeter
Connect, ~~meter~~ across R22 C44.
Adjust the cores in the following order, using hexagonal trimming tool, for maximum reading on meter :-

1. Top core of T8
2. Bottom core of T5
3. Top core of T5
4. Bottom core of T8 for minimum audio output, alternatively for maximum FM output *
5. Transfer signal generator to aerial socket. Still using 10.7 Mc/s AM modulated signal, adjust primary of T3 and then secondary T3 for maximum reading on meter.

Repeat adjustments 1, 2, 3, 4 and 5 again with generator still connected to aerial socket.
The output of the generator should be adjusted so that the voltage reading on the meter reads approximately 3 volts.

Adjust the cores of L1 and T2 so that the bottom ends of the cores are $\frac{3}{8}$" from the printed side of the tuner panel. This measurement is done through the small holes in the panel.
Turn the pointer to 88 Mc/s, inject an 88 Mc/s F.M. modulated signal, tune in the signal with C7.
Connect the valve volt meter (3V A.C. range) to the junction of C5 C6, adjust C8 for minimum reading.
Disconnect the meter and :-

1. Re-adjust C7 for output at 88 Mc/s. Adjustment of C8 alters C7. Turn pointer to 100 Mc/s. Inject 100 Mc/s signal.

2. Adjust coil L2 by opening or closing the turns until the signal is tuned in.

3. Turn pointer to 94 Mc/s. Adjust C4 for maximum output.

Repeat operations 1, 2 and 3 until no further improvements can be obtained.

This completes F.M. alignment.

* middle peaks of three peaks - must be very carefully done.

Adjustment of Tuning Cores T2 and L1:

Should the pointer not coincide with the 94 Mc/s mark on the dial, adjust the core of T2 and L1 as follows :-

When the pointer is to the left of the mark, screw the cores anti-clockwise two turns, or clockwise by the same amount if the pointer is to the right of the mark. When a large amount of pointer movement is required to tune the 88 Mc/s signal, it shows that the cores need turning anticlockwise and vica versa at the 100 Mc/s point.

Repeat operations 1, 2 and 3 above.